Energy Positioning: Control and Economics

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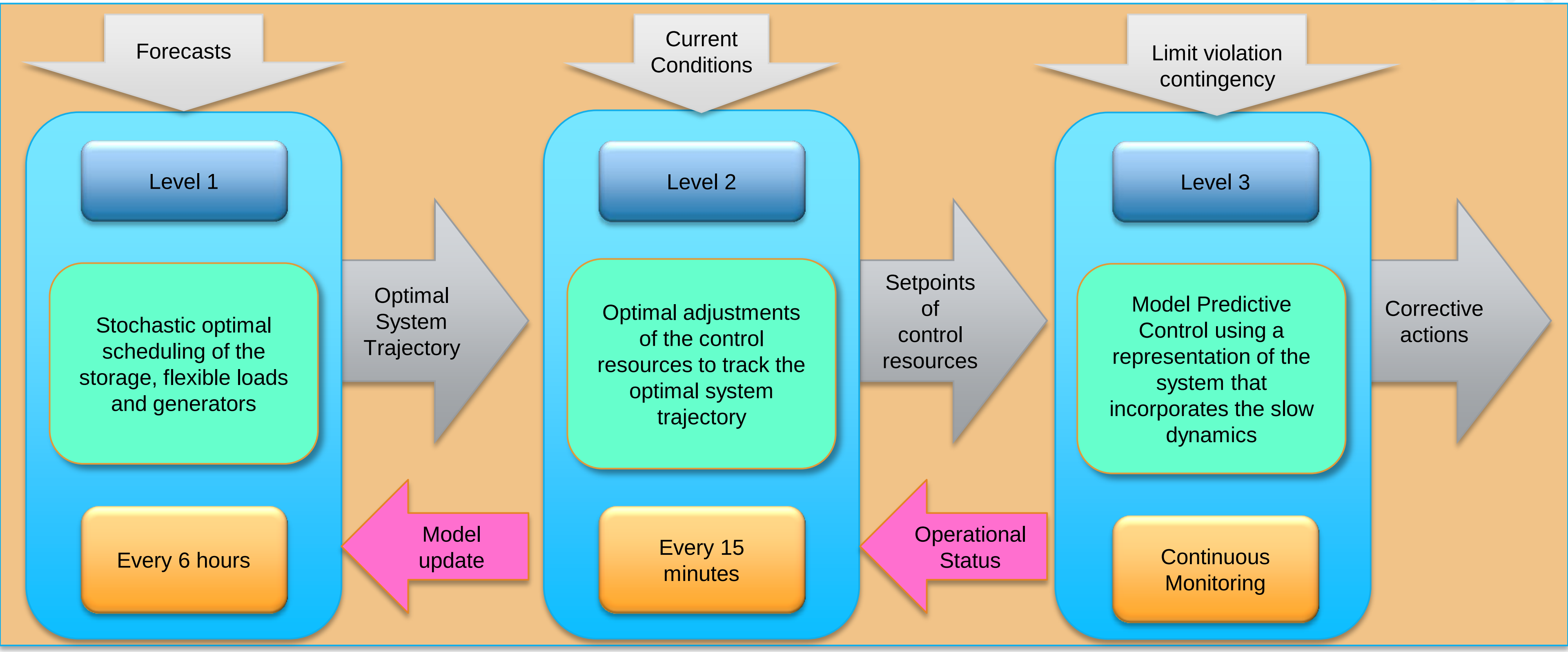
January 21, 2015

Project Objectives

- Develop strategies and tools for:
  - Optimal scheduling of storage and demand response
  - Optimal tracking
  - Optimal post-contingency control
  - Optimal siting and sizing

- Quantify the value of distributed energy storage and demand response in terms of enhanced transmission network utilization:
  - Reduce congestion
  - Defer investments
  - Facilitate post-contingency corrective control
  - Reduce spillage of renewable energy

Approach



CHANGING WHAT'S POSSIBLE

Project Objectives

- Unique aspects:
  - Integration of operation, control and economics aspects
  - Handling of the entire chain: planning to real-time
- Challenges:
  - Integration of different tools:
    - MPC for real-time
    - OPF for tracking
    - UC for scheduling
    - Optimization and heuristics for planning
  - Dimensionality
    - Network constraints & number of storage devices

Metrics

- How much money can we save by using distributed storage and demand response in the operation of the transmission network?
- How much spillage of renewable energy can we avoid?
- At what price does distributed energy storage become a commercially viable proposition?
- Can we perform these calculations in a reasonable amount of time? (i.e. compatible with system operation)

Outcomes

- Demonstrated methodology to calculate the value of storage and demand response
- Developed a set of prototype operation tools validated on a large system
- Gained a better understanding of how storage and demand response should be integrated in the operation of the grid

Accomplishments in 2014

- Integration of the three levels:
  - Scheduling (UC)
  - Tracking (OPF)
  - Real-time control (MPC)

- Setting up the large test case
  - WECC 2024 planning case
  - Optimize on the California part of that system
  - Validated the base case
  - Solving the base case takes a reasonable amount of time

The Home Stretch..

- Get numbers and results on this large, realistic system model

Current Technology-to-Market Activity

- BPA Technology Innovation project

- Partners:
  - Snohomish PUD
    - Installing three 1MW – 0.5 MWh batteries at different substations
  - 1Energy Systems
    - Developing software for control, communications and local optimization
  - University of Washington
    - Level 1 scheduling of these batteries for BPA

Further Technology-to-Market Objectives

- Full scale pilot project involving all three levels
- Integration in the suite of operating tools provided by EMS vendors

Post ARPA-E Goals

- Combination of applications of energy storage
  - Transmission congestion
  - Arbitrage
  - Ancillary services
  - Local (i.e. distribution level) uses

- To what extent can these applications be combined?

- How would this work in a competitive or collaborative environment?